

Appl. No. 10/772,077  
Amtd. Dated September 28, 2005  
Reply to Office Action of June 30, 2005

Attorney Docket No. 88519.0003  
Customer No.: 26021

### REMARKS

This application has been carefully reviewed in light of the Office Action dated June 30, 2005. Claims 1-4 remain in this application. Claims 1-3 are the independent Claims. Claims 1-4 have been amended. It is believed that no new matter is involved in the amendments or arguments presented herein. Reconsideration and entrance of the amendment in the application are respectfully requested.

### Art-Based Rejections

Claims 1-4 were rejected under 35 U.S.C. § 102(a) over U.S. Patent Application No. 2004/0108505 A1 (Tuller). Applicant respectfully traverses the rejections and submits that the claims herein are patentable in light of the clarifying amendments above and the arguments below.

### The Tuller Reference

Tuller is directed to a method of p-type doping in ZnO. According to Tuller, an acceptor-doped material having ZnO is formed under reducing condition, ensuring a high donor density. The specimens of the acceptor-doped material are annealed at intermediate temperatures under oxidizing condition to remove intrinsic donors and activate impurity acceptors. (See, *Tuller*; Page 2, Para. 15).

### The Claims are Patentable Over the Cited References

The present application is generally directed to a ZnO system semiconductor device having a p-type layer formed of a p-type ZnO thin film. The growth direction of the thin film is conformed to the direction of Zn polarity (0001).

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Amended Independent Claim 1

As defined by amended independent Claim 1, a ZnO system semiconductor device having one or more layers of n-type layer and p-type layer respectively is provided. The device is characterized in that at least one layer of the p-type layers is (are) formed of a Zn-polar ZnO system semiconductor film doped with nitrogen atoms, such that the thin film growth direction of said Zn-polar ZnO system semiconductor film is conformed to the direction of Zn polarity (0001). The underlying layer at the time of formation of the Zn-polar ZnO system semiconductor thin film is Zn-polar MgZnO or Ga-polar GaN thin film.

The applied reference is not seen to disclose or suggest the above features of the present invention as defined by amended independent Claim 1. In particular, applied reference does not disclose or suggest, "the underlying layer at the time of formation of said Zn-polar ZnO system semiconductor thin film is Zn-polar MgZnO or Ga-polar GaN thin film," as required by amended independent Claim 1.

According to Tuller, an n-type ZnO film is disposed on a substrate. A p-type ZnO film is disposed on the n-type ZnO film. (See, *Tuller; Page 3, Para. 31; Figures 4A-4D*). Tuller does not teach or suggest a Zn-polar MgZnO underlying layer, as required by amended independent Claim 1. (See, *Specification; Figure 6B*).

Moreover, Tuller does not teach or suggest a Ga-polar GaN underlying layer, as required by amended independent Claim 1. (See, *Specification; Figures 2, 4A, 4B, 5A, 5B, 6A*). Applicant notes Tuller references N-polar GaN as an example of undergoing reconstruction similar to the ZnO layer. (See, *Tuller; Page 3, Para. 35*). However, G-polar GaN and an underlying layer thereof are not specifically disclosed by Tuller.

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Accordingly, the applied reference does not teach or suggest the above features of the present invention as recited in the amended independent Claim 1.

Since the cited reference fails to disclose, teach or suggest the above features recited in amended independent Claim 1, the reference cannot be said to anticipate or render obvious the invention which is the subject matter of the claim.

Accordingly, amended independent Claim 1 is believed to be in condition for allowance and such allowance is respectfully requested.

**Amended Independent Claim 2**

As defined by amended independent Claim 2, a ZnO system semiconductor device having one or more layers of n-type layer and p-type layer respectively is provided. The device is characterized in that at least one layer of the p-type layers is (are) formed of a Zn-polar ZnO system semiconductor film doped with nitrogen atoms, such that the thin film growth direction of said Zn-polar ZnO system semiconductor film is conformed to the direction of Zn polarity (0001). A composition of the Zn-polar ZnO system semiconductor film is ZnCdO, ZnMgO, ZnCdMgO, ZnOSe, or ZnOS.

The applied reference is not seen to disclose or suggest the above features of the present invention as defined by amended independent Claim 2. In particular, applied reference does not disclose or suggest, "a composition of said Zn-polar ZnO system semiconductor film is ZnCdO, ZnMgO, ZnCdMgO, ZnOSe, or ZnOS," as required by amended Claim 2.

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Tuller is direct to a method of p-type doping in ZnO. However, Tuller is silent regarding the Zn-polar ZnO film includes ZnCdO, ZnCdO, ZnMgO, ZnCdMgO, ZnOSe, or ZnOS, as required by amended independent Claim 2.

Accordingly, the applied reference does not teach or suggest the above features of the present invention as recited in the amended independent Claim 2.

Since the cited reference fails to disclose, teach or suggest the above features recited in amended independent Claim 2, the reference cannot be said to anticipate or render obvious the invention which is the subject matter of the claim.

Accordingly, amended independent Claim 2 is believed to be in condition for allowance and such allowance is respectfully requested.

**Amended Independent Claim 3**

As defined by amended independent Claim 3, a ZnO system semiconductor device having one or more layers of n-type layer and p-type layer respectively is provided. The device is characterized in that at least one layer of the p-type layers is (are) formed of a Zn-polar ZnO system semiconductor film doped with nitrogen atoms, such that the thin film growth direction of said Zn-polar ZnO system semiconductor film is conformed to the direction of Zn polarity (0001). A composition of the n-type layer is Zn(OS), Zn(OSe), Zn(OTe), Zn(OSSe), Zn(OSeTe) or Zn(OSTe).

The applied reference is not seen to disclose or suggest the above features of the present invention as defined by amended independent Claim 3. In particular, applied reference does not disclose or suggest, "a composition of said n-type layer is

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Zn(OS), Zn(OSe), Zn(OTe), Zn(OSSe), Zn(OSeTe) or Zn(OSTe)," as required by amended Claim 3.

Tuller is direct to a method of p-type doping in ZnO disposed on a n-type ZnO layer. However, Tuller is silent regarding the n-type ZnO layer includes Zn(OS), Zn(OSe), Zn(OTe), Zn(OSSe), Zn(OSeTe) or Zn(OSTe), as required by amended independent Claim 3.

Accordingly, the applied reference does not teach or suggest the above features of the present invention as recited in the amended independent Claim 3.

Since the cited reference fails to disclose, teach or suggest the above features recited in amended independent Claim 3, the reference cannot be said to anticipate or render obvious the invention which is the subject matter of the claim.

Accordingly, amended independent Claim 3 is believed to be in condition for allowance and such allowance is respectfully requested.

The remaining claim depends directly from amended independent Claims 1, 2, or 3 and recite additional features of the invention which are neither disclosed nor fairly suggested by the applied reference and is therefore also believed to be in condition for allowance.

#### Conclusion

In view of the foregoing, it is respectfully submitted that the application is in condition for allowance. Reexamination and reconsideration of the application, as amended, are requested.

If for any reason the Examiner finds the application other than in condition for allowance, the Examiner is requested to call the undersigned attorney at the Los

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Attorney Docket No. 88519.0003  
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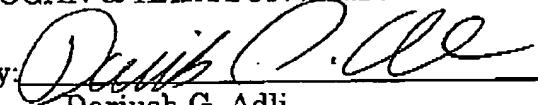
Angeles, California telephone number (213) 337-6809 to discuss the steps necessary for placing the application in condition for allowance.

If there are any fees due in connection with the filing of this response, please charge the fees to our Deposit Account No. 50-1314.

Respectfully submitted,

HOGAN & HARTSON L.L.P.

Date: September 28, 2005

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